Chesterfield County Stream Watcher Program

Stream Habitat Walk

The Stream Habitat Walk is an easy-to-use approach for identifying and assessing the elements of a stream's habitat. It is based on a simple protocol known as *Streamwalk*, developed by EPA's Regional Office in Seattle, Washington and consists primarily of visual observation of stream habitat characteristics, wildlife present, and gross physical attributes. An optional simple in-stream macroinvertebrate evaluation can also be performed. This approach requires little in the way of equipment and training.

The Stream Habitat Walk is most useful as:

- A screening tool to identify severe water quality problems
- A vehicle for learning about stream ecosystems and environmental stewardship

The Stream Habitat Walk's ease of use, adaptability, and low cost make it a highly attractive approach to the County's comprehensive program to assess the health of streams throughout the County. Data collected from the Stream watcher program will be included in the water quality monitoring component of our Annual Report submitted to the Department of Environmental Quality (DEQ). Information obtained by the Stream Watchers will not only provide county staff with key data on physical changes taking place in the streams, but they will also be able to identify activities that may be adversely affecting the stream.

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Step 1--Prepare for the Walk

TASK 1 *Schedule your Habitat Walk*

To provide data that accurately characterize your stream and can be used to document general trends in your area, you should walk the same site at least two times a year, during different seasons. It is usually best to visit your site in early spring, late summer, or fall to incorporate seasonal variations in leaf cover, vegetation growth, and water flow. For purposes of accuracy and consistency, it is best to monitor the same site from year to year and at the same time of the year (e.g., in the spring and, more specifically, in the same month).

TASK 2 *Obtain from the County a GIS topographic map of your area*

One of the most valuable tools for conducting stream monitoring work is a Geographical Information System (GIS) topographic map. Each Stream Watcher will be given a County GIS "topo" map displaying many important features of the landscape including elevations, waterways, roads, land use and property lot lines. They are critical tools for defining the watershed of your study stream.

TASK 3 *Select and mark the Habitat Walk location(s)*

Selection of the location for stream monitoring will be up to the Stream Watcher. A Stream Watcher may want to select a stream that is of personal interest. However, the county can select your site if you do not have one in mind. Once a monitoring site is chosen, it will be incorporated into the County's GIS system. This will document the location and serve as a record in case future volunteers or data users need to find the site.

TASK 4 *Become familiar with safety procedures*

Volunteers must always keep safety in mind while conducting any stream monitoring activity. **A list of safety do's and don'ts have been included in the back of this document under Safety Considerations.** Please review this list thoroughly. Remember, your safety is more important than the data. Some reminders include:

- Let someone know where you're going and when you expect to return. Make sure you have an "in case of emergency" phone number with you before leaving for the field.
- Do not cross streams in high flows.
- Never go into the field alone; always work in teams of at least two people.
- If for any reason you feel unsafe, do not attempt to monitor on that day.

TASK 5 *Gather equipment and tools for the Habitat Walk*

There is nothing more frustrating than arriving at a field monitoring site and not having all your equipment and supplies. Volunteers will be given a carry case and checklist and all the necessary items to complete their monitoring. You will need the basic equipment listed below for the Stream Habitat Walk.

For locating the site

- County GIS topographic map of the stream area

For recording observations

- Stream Habitat Walk Document

- Stream Habitat Walk field data sheet
- Clipboard
- Water proof pen or pencil
- Disposal camera

For marking-off the stream stretch of study
- Tape measure, string, or twine (25 yards)
- Marker tape

For working in and around the stream
- Thermometer for measuring water temperature
- Watch with a second hand or a stopwatch
- Bank pins and hammer

For cleaning up of trash and debris
- Heavy duty trash bags
- Gloves

For observing macroinvertebrates (**optional**)
- A bucket
- A shallow white pan.
- Tweezers & Magnifying glass
- Ice cube trays (for sorting macroinvertebrates)

TASK 6 *Become familiar with the Stream Habitat Walk field data sheet and the definitions of its elements*

It is important to become familiar with the Stream Habitat Walk field data sheet and its instructions before you begin your Stream Habitat Walk. If you are unclear about any instructions when you are conducting your Walk, just leave that space blank and keep going. Contact the county program coordinator Heather Barrar (748-1920) for further explanation after you have completed your Walk.

When you fill out your field data sheet, base your responses on your best judgment of conditions in a stretch of stream that includes about 50 yards both upstream and downstream of the place where you are standing. If you identify features and problems beyond your chosen 100-yard length, feel free to note them on your map and form. You might want to conduct additional Walks in the area where those features are found.

Instructions on how to fill out the field data sheet are included on the form. A copy of the form can be found on page 20 of this document. Questions on the form are also covered in an expanded format, with illustrations, in this text. Although many of the required measures are relatively self-explanatory, it might be a good idea to take these instructions into the field.

Step 2--Delineate and sketch your site

TASK 1 *Delineate the site*

Using your tape measure or 25 yards of string or twine, measure off four 25-yard lengths alongside the stream for a total of 100 yards. Start from a point of reference such as a tree, large rock, or bend in the stream. Using marker tape, mark the start and end points of your 100 yard site.

TASK 2 *Sketch your site on the field data sheet*

On the field data sheet, sketch the 100-yard section of your stream. For an example see Figure 1. Drawing the map will familiarize you with the terrain and stream features and provide you and other volunteers with a visual record of your habitat walk. You should walk the 100-yard length from at least one bank. Use your camera photos to document the areas of your stream. Take as many photos as needed. Be sure to take photos all along the 100 yard reach of your stream and include important features like erosion points, sand bars, fallen trees, riffle areas, etc. Make a written record of each photo or document it on your sketch.

On your sketch, note features such as riffles, runs, pools, ditches, wetlands, dams, rip-rap, outfalls, tributaries, landscape features, jogging paths, vegetation, areas of erosion and roads. Use your County's GIS map or a compass to determine which direction is north and mark it on your sketch. If you see important features outside your 100-yard length of stream, mark them on your sketch but note that they are outside the stream reach. Remember to use pencil or waterproof ink when drawing your map or filling out the field data sheets because regular ink will run if wet.

Select a 25-yard section of the site. You will be filling out your field data sheet for this section only. Mark the section on the sketch. If you want to conduct multiple walks, choose another 25-yard section or move to an entirely different location. Even though you will only be completing the data forms for the 25-yard reach, it is important to sketch the full 100-yard section so that you can document the stream features surrounding the evaluated reach.

TASK 3 *Complete the top portion of your field data sheet*

Include stream name and date for your site, and describe its location as precisely as possible. It is best to stand at or near a permanent marker such as a bridge, abutment, or road. Remember, you or another volunteer will be coming back to the same spot again and again, so be as specific as you can. The latitude and longitude of your location will also be noted on your county GIS map.

Latitude and longitude information is critical for mapping and for many data management programs. It is also required if the data is to be entered in USEPA's STOrage and RETrieval System (STORET) or used in (GIS).

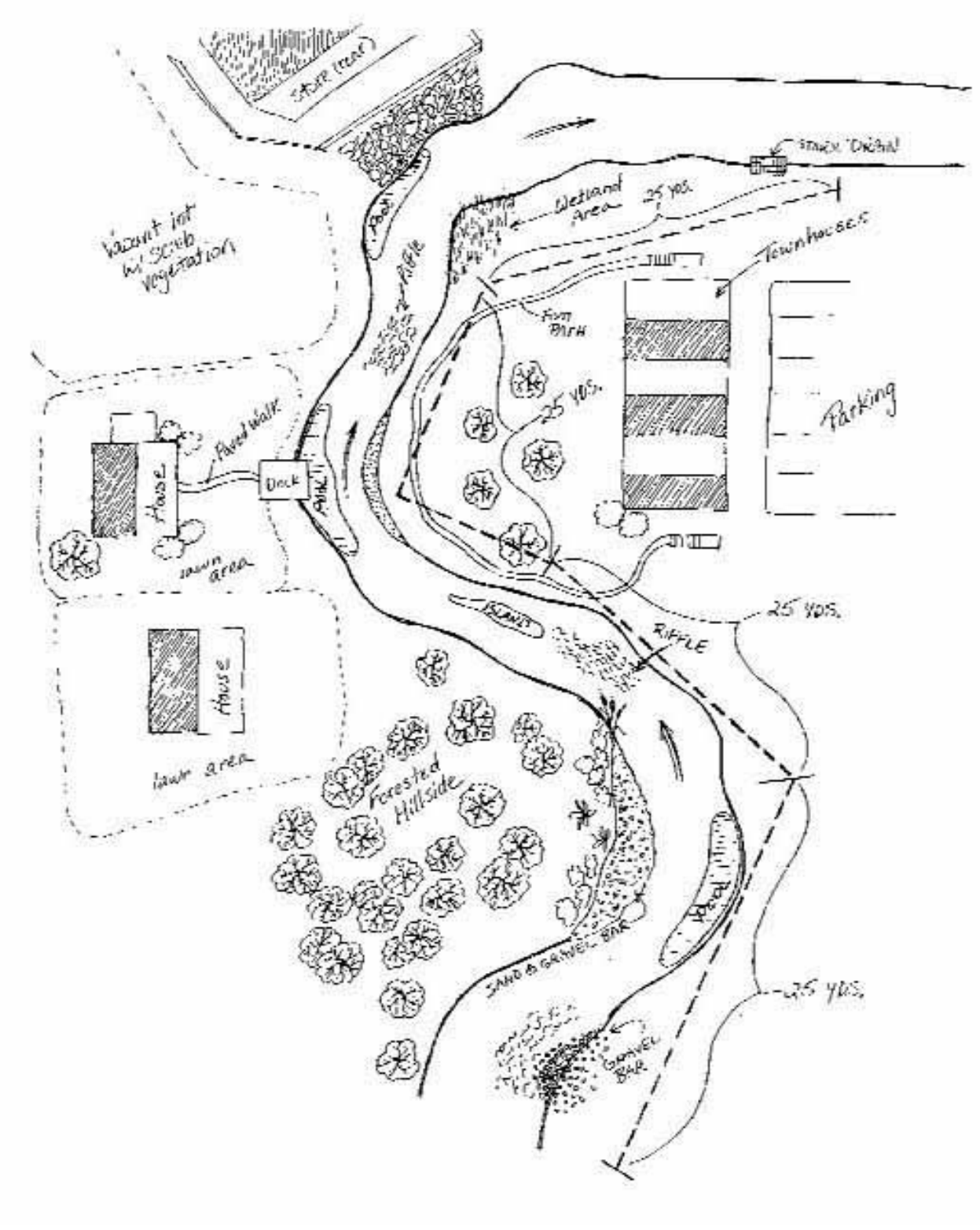

Figure 1.

Example of a stream sketch.
Volunteers should note important stream features on their sketch including riffles and pools.

Step 3--Conduct the Stream Habitat Walk

Detailed instructions for performing the Stream Habitat Walk begins following Step 4 of this section on page 8.

TASK 1 ***Complete the habitat characterization components of the walk for the 25-yard section of stream: the "In-Stream Characteristics," "Stream Bank and Channel Characteristics," and "Local Watershed Characteristics" sections of the field data sheet***

These elements involve making observations about the stream itself as well as the riparian zone and immediate watershed.

TASK 2 ***Complete the "Visual Biological Survey" section of the field data sheet***

This involves simple visual observations of the presence or absence of wildlife and obvious aquatic life in the stream, including fish, aquatic plants, and algae.

TASK 3 ***Place bank pins in areas of erosion or potential erosion***

If there are areas of erosion located within your stream segment, use the bank pins to monitor these locations. The pins should be placed above and below the area of erosion. Indicate these areas on your sketch of your stream segment and document the area with photos. The pins should be left in place and monitored each time you return to your site.

TASK 4 ***Clean-up any trash or debris that may be found in the stream section***

TASK 5 ***Complete the "Macroinvertebrate Survey" section of the field data sheet***

This is optional and serves as an introduction to the types of life that inhabit some of the microhabitats of the stream, the spaces under and on rocks and in and on twigs and leaves. To conduct this survey, you will need to select the method(s) that best suits your stream. Use the rock-rubbing method in streams with riffles, or use the stick-picking method if your stream does not have riffles. Clumps of submerged leaves may be present in either type of stream and are often an important microhabitat for macroinvertebrates. You may choose to sort through these leaf packs in addition to rock-rubbing or stick-picking.

You will also need some specific equipment (a bucket, tweezers, etc.). Be sure to dress appropriately because you'll probably get wet.

Remember to return the organisms to the stream when you finish the macroinvertebrate survey. Then, check to make sure your field data sheet has been completed as fully as possible.

Step 4--Check data forms for completeness and return forms to program coordinator

After completing the habitat characterization and, if conducted, macroinvertebrate survey, make sure you have completed the field data sheet to the extent possible and that the recorded data are legible. If you are not able to determine how to answer a question on the field data sheet, just leave the space blank. If you leave a space blank, indicate that it is because you are not able to answer the question (e.g., write "not able to answer" or "does not apply" in the space). Once you have completed the Stream Habitat Walk, present a copy of the field data sheet and stream photos to the County project coordinator. The address is:

Chesterfield County
Attn: Heather Barrar
Environmental Engineering
P.O. Box 40
Chesterfield VA 23832-0040

You may want to keep a copy of the field data sheet, and other appropriate data, for your own records and to evaluate any future discrepancies in the data.

If you have identified an urgent problem, such as leaking drums of chemicals, foul odors, or fish kills. Phone the County's Hot Line at 717-6161 as soon as possible.

Instructions for completing the Stream Habitat Walk data sheet

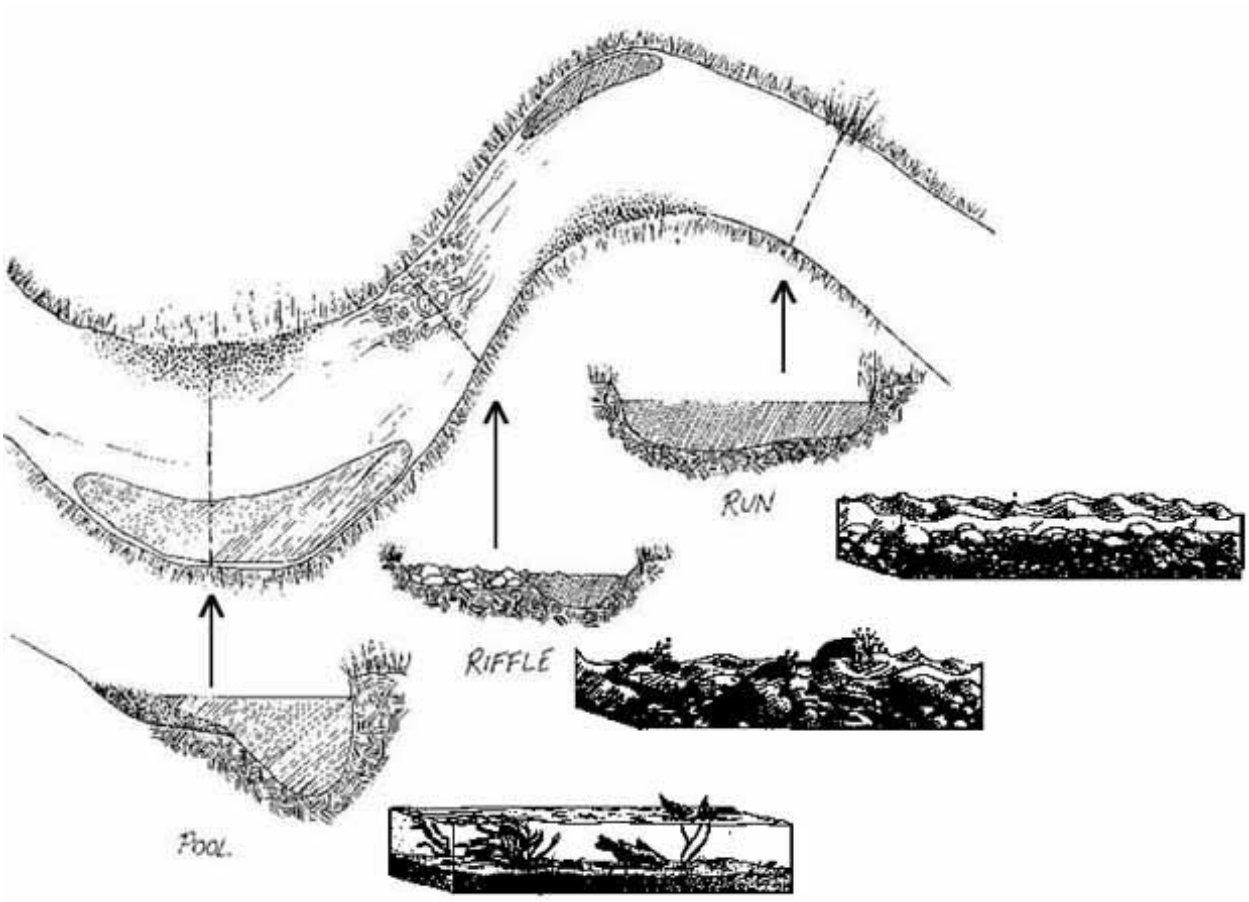

Figure 2.

Overview and cross sections of a pool, riffle, and run.
Varying flows and depths create a variety of habitats for macroinvertebrates.

For ease of use, the following numbered instructions correspond to the numbers on the field data sheet.

In-stream Characteristics

1. *Pools, riffles, and runs.* A mixture of flows and depth, provide a variety of habitats to support fish and invertebrate life. Pools are deep with slow water. Riffles are shallow with fast, turbulent water running over rocks. Runs are deep with fast water and little or no turbulence. For an overview see Figure 2.

2. *Stream bottom (substrate)* is the material on the stream bottom. Identify what substrate types are present. Substrate types include:

   - *Silt/clay/mud.* This substrate has a sticky, cohesive feeling. The particles are fine. The spaces between the particles hold a lot of water, making the sediments behave like ooze.

   - *Sand (up to 0.1 inch).* A sandy bottom is made up of tiny, gritty particles of rock that are smaller than gravel but coarser than silt (gritty, up to ladybug size).

   - *Gravel (0.1-2 inches).* A gravel bottom is made up of stones ranging from tiny quarter-inch pebbles to rocks of about 2 inches (fine gravel - pea size to marble size; coarse gravel - marble to tennis ball size).

   - *Cobbles (2-10 inches).* Most rocks on this type of stream bottom are between 2 and 10 inches (between a tennis ball and a basketball).

   - *Boulders (greater than 10 inches).* Most of the rocks on the bottom are greater than 10 inches (between a basketball and a car in size).

   - *Bedrock.* This kind of stream bottom is solid rock (or rocks bigger than a car).

3. *Embeddedness* is the extent to which rocks (gravel, cobbles, and boulders) are sunken into the silt, sand, or mud of the stream bottom (Fig. 3). Generally, the more rocks are embedded, the less rock surface or space between rocks is available as habitat for aquatic macroinvertebrates and for fish spawning. Excessive silty runoff from erosion can increase a stream's embedded-ness. To estimate embeddedness, observe the amount of silt or finer sediments overlying, in between, and surrounding the rocks.

4. *Presence of logs or woody debris (not twigs and leaves) in stream* can slow or divert water to provide important fish habitat such as pools and hiding places. Mark the box that describes the general amount of woody debris in the stream.

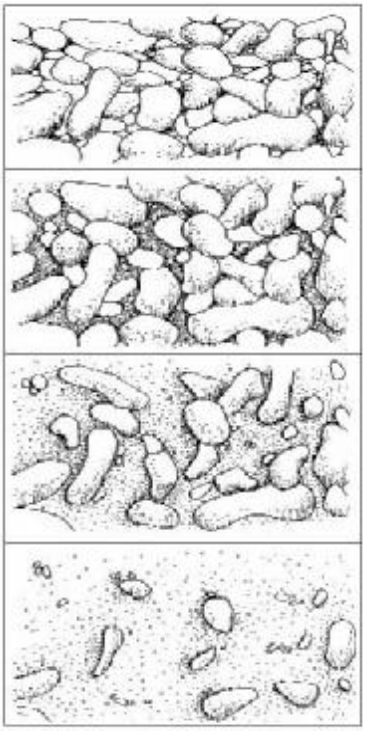

Figure 3.

A representation of a rocky-bottom stream becoming embedded with sand and silt.

5. *Naturally occurring organic material in stream.* This material includes leaves and twigs. Mark the box that describes the general amount of organic matter in the stream.

6. *Water appearance* can be a physical indicator of water pollution.

   - *Clear* - colorless, transparent
   - *Milky* - cloudy-white or gray, not transparent; might be natural or due to pollution
   - *Foamy* - might be natural or due to pollution, generally detergents or nutrients (foam that is several inches high and does not brush apart easily is generally due to some sort of pollution)
   - *Turbid* - cloudy brown due to suspended silt or organic material
   - *Dark brown* - might indicate that acids are being released into the stream due to decaying plants
   - *Oily sheen* - multicolored reflection might indicate oil floating in the stream, although some sheens are natural
   - *Orange* - might indicate acid drainage or precipitation of iron from iron loving bacteria
   - *Green* - might indicate excess nutrients being released into the stream

7. *Water odor* can be a physical indicator of water pollution

   - No smell or a natural odor
   - Sewage - might indicate the release of human waste material
   - Chlorine - might indicate over-chlorinated sewage treatment/water treatment plant or swimming pool discharges
   - Fishy - might indicate excessive algal growth or dead fish
   - Rotten eggs - might indicate sewage pollution (the presence of methane from anaerobic conditions)

8. *Water temperature* can be particularly important for determining the suitability of the stream as aquatic habitat for some species of fish and macroinvertebrates that have distinct temperature requirements. Temperature also has a direct effect on the amount of dissolved oxygen available to the aquatic organisms. Measure temperature by submerging a thermometer for at least 2 minutes in a typical stream run. Repeat once and average the results.

Stream Bank and Channel Characteristics

9. *Depth of runs and pools* should be determined by estimating the vertical distance from the surface to the stream bottom at a representative depth at each of the two habitats.

10. *The width of the stream channel* can be determined by estimating the width of the streambed that is covered by water from bank to bank. If it varies widely, estimate an average width.

11. *Stream velocity* can have a direct influence on the health, variety, and abundance of aquatic communities. If water flows too quickly, organisms might be unable to maintain their hold on rocks and vegetation and be washed downstream; if water flows too slowly, it might provide insufficient aeration for species needing high levels of dissolved oxygen. Stream velocity can be affected by dams, channelization, terrain, runoff, and other factors. To measure stream velocity, mark off a 10-foot section of stream run and measure the time it takes a stick, leaf, or other floating biodegradable object to float the 10 feet. Repeat 3 times and pick the average time. Divide the distance (10 feet) by the average time (seconds) to determine the velocity in feet per second.

12. *The shape of the stream bank, the extent of artificial modifications, and the shape of the stream channel* are determined by standing at the downstream end of the 25-yard section and looking upstream.

    a. The shape of the stream bank (Fig. 4) may include.

    - *Vertical or undercut bank* - a bank that rises vertically or overhangs the stream. This type of bank generally provides good cover for macroinvertebrates and fish and is resistant to erosion. However, if seriously undercut, it might be vulnerable to collapse.

    - *Steeply sloping* - a bank that slopes at more than a 30 degree angle. This type of bank is very vulnerable to erosion.

    - *Gradual sloping* - a bank that has a slope of 30 degrees or less. This type of stream bank is highly resistant to erosion, but does not provide much streamside cover.

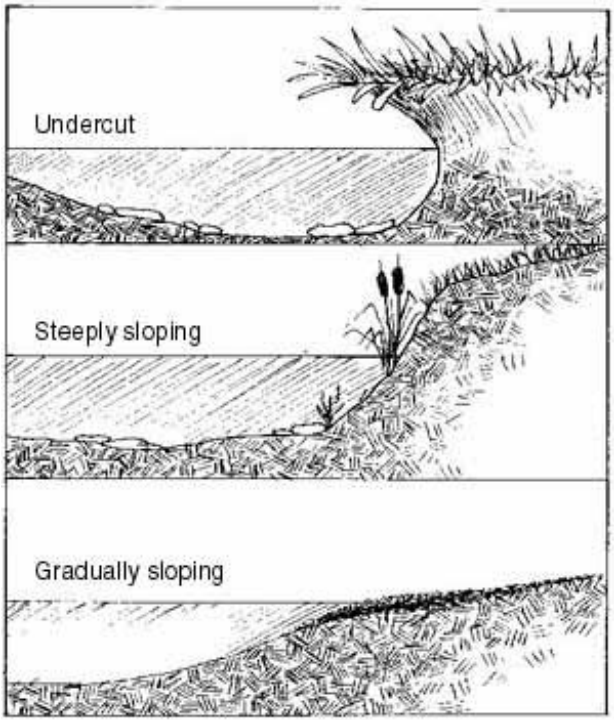

Figure 4.

Types of stream bank shapes
Undercut banks provide good cover for fish and macroinvertabrates.

b. *Artificial bank modifications* include all artificial structural changes to the stream bank such as rip-rap (broken rock, cobbles, or boulders placed on earth surfaces such as the face of a dam or the bank of a stream, for protection against the action of the water) and bulkheads. Determine the approximate percentage of each bank (both the left and right) that is artificially covered by the placement of rocks, wood, or concrete.

c. *The shape of the stream channel* can be described as narrow (less than 6 feet wide from bank to bank), wide (more than 6 feet from bank to bank), shallow (less than 3 feet deep from the stream substrate to the top of the banks) or deep (more than 3 feet from the stream substrate to the top of the banks). Choose the category that best describes the channel.

- **Narrow, deep** – (less than 6 feet wide from bank to bank), (more than 3 feet from the stream substrate to the top of the banks)
- **Narrow, shallow** - (less than 6 feet wide from bank to bank), (less than 3 feet deep from the stream substrate to the top of the banks)
- **Wide, deep** - (more than 6 feet from bank to bank), (more than 3 feet from the stream substrate to the top of the banks)
- **Wide, shallow** – (more than 6 feet from bank to bank), (less than 3 feet deep from the stream substrate to the top of the banks)

13. *Streamside cover* information helps determine the quality and extent of the stream's riparian zone. This information is important at the stream bank itself and for a distance away from the stream bank. For example, trees, bushes, and tall grass can contribute shade and cover for fish and wildlife and can provide the stream with needed organic material such as leaves and twigs. Lawns indicate that the stream's riparian zone has been altered, that pesticides and grass clippings are a possible problem, and that little habitat and shading are available. Bare soil and pavement might indicate problems with erosion and runoff. Looking upstream, provide this information for the left and right banks of the stream.

- *Evergreen trees (conifers)* - cone-bearing trees that do not lose their leaves in winter.
- *Hardwood trees (deciduous)* - in general, trees that shed their leaves at the end of the growing season.
- *Bushes, shrubs* - conifers or deciduous bushes less than 15 feet high.
- *Tall grass, ferns, etc.* - includes tall natural grasses, ferns, vines, and mosses.
- *Lawn* - cultivated and maintained short grass.

- *Boulders* - rocks larger than 10 inches.
- *Gravel/cobbles/sand* - rocks smaller than 10 inches; sand.
- *Bare soil*
- *Pavement, structure* - any structures or paved areas, including paths, roads, bridges, houses, etc.

14. *Stream shading* is a measurement of the extent to which the stream itself is overhung and shaded by the cover identified in #13. above. This shade (or overhead canopy) provides several important functions in the stream habitat. The canopy cools the water; offers habitat, protection, and refuge for aquatic organisms; and provides a direct source of beneficial organic matter and insects to the stream. Determine the extent to which vegetation shades the stream at your site.

15. *General conditions of the stream bank and stream channel, and other conditions* that might be affecting the stream are determined by standing at the downstream end of the 25-yard site and looking upstream. Provide observations for the right and left banks of the stream.

    a. *Stream bank conditions* that might be affecting the stream.

    - *Natural plant cover degraded.* Note whether streamside vegetation is trampled or missing or has been replaced by landscaping, cultivation, or pavement. These conditions could lead to erosion.
    - *Banks collapsed/eroded.* Note whether banks or parts of banks have been washed away or worn down. These conditions could limit habitats in the area.
    - *Garbage/junk adjacent to the stream.* Note the presence of litter, tires, appliances, car bodies, shopping carts, and garbage dumps.
    - *Foam or sheen on bank.* Note whether there is foam or an oily sheen on the stream bank. Sheen may indicate an oil spill or leak, and foam may indicate the presence of detergent.

    b. *Stream channel conditions* that might be affecting the stream.

    - *Mud/silt/sand on bottom/entering stream.* Excessive mud or silt can interfere with the ability of fish to sight potential prey. It can clog fish gills and smother fish eggs in spawning areas in the stream bottom. It can be an indication of poor construction practices, urban area runoff, silviculture (forestry-related activities), or agriculture in the watershed. It can also be a normal condition, especially in a slow-moving, muddy-bottom stream.

- *Garbage or junk in stream.* Note the presence of litter, tires, appliances, car bodies, shopping carts, and garbage.

c. *Other general conditions* that might be affecting the stream.

- *Yard waste (e.g., grass clippings)* - is there evidence that grass clippings, cut branches, and other types of yard waste have been dumped into the stream?

- *Livestock in or with unrestricted access to stream* - are livestock present, or is there an obvious path that livestock use to get to the water from adjacent fields? Is there streamside degradation caused by livestock?

- *Actively discharging pipes* - are there pipes with visible openings discharging fluids or water into the stream? Note such pipes even though you may not be able to tell where they come from or what they are discharging.

- Other *pipes* - are there pipes near or entering the stream? Note such pipes even if you cannot find an opening or see matter being discharged.

- *Ditches* - are there ditches, draining the surrounding land and leading into the stream?

Local Watershed Characteristics

16. *Adjacent land uses* can potentially have a great impact on the quality and state of the stream and riparian areas. Determine the land uses, based on your own judgment of the activities in the watershed surrounding your site within a quarter of a mile. Enter a "1" if a land use is present and a "2" if it is clearly having a negative impact on the stream.

Visual Biological Survey

17. *Wildlife* in the stream area might indicate it is of sufficient quality to support animals with food, water, and habitat. Look for signs of frogs, turtles, snakes, ducks, deer, beaver, etc.

18. Are *fish* present in the stream? Fish can indicate that the stream is of sufficient quality for other organisms. Indicate the average size and note any visible barriers to the movement of fish in the stream - obstructions that would keep fish from moving freely upstream or downstream.

19. *Aquatic plants* provide food and cover for aquatic organisms. Plants also might provide very general indications of stream quality. For example, streams that are overgrown with plants could be over enriched by nutrients. Streams devoid of plants could be affected by extreme acidity or toxic pollutants. Aquatic plants may also be an indicator of stream velocity because plants cannot take root in fast-flowing streams.

20. *Algae* are simple plants that do not grow true roots, stems, or leaves and that mainly live in water, providing food for the food chain. Algae may grow on rocks, twigs, or other submerged materials, or float on the surface of the water. The algae naturally occurs in green and brown colors. Excessive algal growth may indicate excessive nutrients (organic matter or a pollutant such as fertilizer) in the stream.

Macroinvertebrate Survey (optional)

21. *Macroinvertebrates* are organisms that lack a backbone and can be seen with the naked eye such as clams, mussels, snails, worms, crayfish, and larval insects. To locate macroinvertebrates in the stream, use one or more of the following methods.

    a. *Rock-rubbing method*. (Use this method in streams with riffle areas and rocky bottoms.)

    - Remove several rocks from within a riffle area of your stream site (e.g., randomly pick 1 rock from each side of the stream, 1 rock from the middle, and 1 rock from in between). Try to choose rocks that are submerged during normal flow conditions. Each rock should be about 4-6 inches in diameter and should be easily moved (not embedded).

    - Either inspect the rock's surface for any living organisms or place the rock in a light-colored bucket or shallow pan, add some stream water, and brush the rock with a soft brush or your hands. Try to dislodge the foreign particles from the rock's surface. Also look for clumps of gravel or leaves stuck to the rock. These clumps may be caddisfly houses and should be dislodged as well.

    b. *Stick-picking method.* (Use this method in streams without riffles or without a rock bottom.)

    - Collect several sticks (approximately 1 inch in diameter and relatively short) from inside the stream site, and place then in a bucket filled with stream water. Select partially decomposed objects that have soft, pulpy wood and a lot of crevices and are found in the flowing water, not buried in the bottom. Pick the loose bark from the sticks to find organisms.

    - Fill the shallow pan with water from the stream and remove one of the sticks from the bucket. Examine the stick making sure you hold it over the pan so no organisms are lost. Remember that the organisms will have sought shelter, and they could be hiding in loose bark or crevices. After examining the sticks, it might be helpful to break up the woody material. Examine each stick carefully. Using tweezers or a soft brush, carefully remove anything that resembles a living organism and place it in the pan. Also examine the bucket contents for anything that has fallen off the sticks.

c. *Leaf pack-sorting method.* (This method can be used in streams with or without a rock bottom.)

- Remove several handfuls of submerged leaves from the stream and place them into a bucket. Remove the leaves one at a time and look closely for the presence of insects. Using tweezers or soft brush, carefully remove anything that resembles a living organism and place it in a pan containing stream water. Also examine the bucket contents to see if anything has fallen off the leaves.

22. Note whether you have found any *macroinvertebrates* using one of the above methods.

23. After collecting *macroinvertebrates* using any of the above methods, examine the types of organisms by gross morphological features (e.g., snails or worm-like). Use a magnifying glass to observe the organisms in water so you can clearly see the legs, gills, and tails. Note the relative abundance of each type on the field data sheet. When finished, return all the organisms to the stream.

    Many types of macroinvertebrates can be found in a healthy stream. Because different species can tolerate different levels of pollution, observing the variety and abundance of macroinvertebrates can give you a sense of the stream's health. For example, if pollution tolerant organisms are plentiful and pollution intolerant ones are found only occasionally, this might indicate a problem in the stream. Types of organisms you find may include:

    - *Worm-like organisms (like worms and leeches)* either adhere to rocks or sticks or move slowly. They are generally tolerant of pollution.

    - *Crayfish* look like small lobsters or shrimp. They are generally somewhat tolerant of pollution.

    - *Snail-like organisms* include snails and clam-like organisms. They range from somewhat tolerant of pollution to somewhat intolerant.

    - *Insects* include a wide variety of organisms that generally have distinct legs, head, bodies, and tails and often move quickly over rocks or sticks. They come in many sizes and shapes as well as a wide range of pollution-tolerance levels.

When finished, return all organisms to the stream.

Safety Considerations

One of our most critical consideration is the safety of our volunteers. All volunteers should become familiar with the safety procedures listed below and ask any questions or comment as they feel necessary. The safety procedures should be carry while in the field. Safety precautions can never be overemphasized.

The following are some basic common sense safety rules. At the site:

- Always monitor with at least one partner. Teams of three or four people are best. Always let someone else know where you are, when you intend to return, and what to do if you don't come back at the appointed time.

- Develop a safety plan. Find out the location and telephone number of the nearest telephone and write it down. Locate the nearest medical center and write down directions on how to get between the center and your site(s) so that you can direct emergency personnel. Have each member of the sampling team complete a medical card that includes emergency contacts, insurance information, and pertinent health information such as allergies, diabetes, epilepsy, etc.

- Have a first aid kit handy (see below). Know any important medical conditions of team members (e.g., heart conditions or allergic reactions to bee stings). It is best if at least one team member has first aid/CPR training.

- Listen to weather reports. Never go sampling if severe weather is predicted or if a storm occurs while at the site.

- Never wade in swift or high water. Do not monitor if the stream is at flood stage.

- If you drive, park in a safe location. Be sure your car doesn't pose a hazard to other drivers and that you don't block traffic.

- Put your wallet and keys in a safe place, such as a watertight bag you keep in a pouch strapped to your waist. Without proper precautions, wallet and keys might end up downstream.

- Never cross private property without the permission of the landowner. Better yet, sample only at public access points such as bridge or road crossings or public parks. Take along a card identifying you as a volunteer monitor.

- Confirm that you are at the proper site location by checking maps, site descriptions, or directions.

- Watch for irate dogs, farm animals, wildlife (particularly snakes), and insects such as ticks, hornets, and wasps. Know what to do if you get bitten or stung.
- Watch for poison ivy, poison oak, sumac, and other types of vegetation in your area that can cause rashes and irritation.

- Never drink the water in a stream. Assume it is unsafe to drink, and bring your own water from home. After monitoring, wash your hands with antibacterial soap.

- Do not monitor if the stream is posted as unsafe for body contact. If the water appears to be severely polluted, contact the County's project coordinator.

- Do not walk on unstable stream banks. Disturbing these banks can accelerate erosion and might prove dangerous if a bank collapses. Disturb streamside vegetation as little as possible.

- Be very careful when walking in the stream itself. Rocky-bottom streams can be very slippery and can contain deep pools; muddy-bottom streams might also prove treacherous in areas where mud, silt, or sand have accumulated in sink holes. If you must cross the stream, use a walking stick to steady yourself and to probe for deep water or muck. Your partner(s) should wait on dry land ready to assist you if you fall. Do not attempt to cross streams that are swift and above the knee in depth. Wear waders and rubber gloves in streams suspected of having significant pollution problems.

- If you are sampling from a bridge, be wary of passing traffic. Never lean over bridge rails unless you are firmly anchored to the ground or the bridge with good hand/foot holds.

- **If at any time you feel uncomfortable about the condition of the stream or your surroundings, stop monitoring and leave the site at once. Your safety is more important than the data!**

First Aid Kit

The minimum first aid kit should contain the following items:

Telephone numbers of emergency personnel such as the police and an ambulance service.

- Several Band-Aids for minor cuts.

- Antibacterial or alcohol wipes.

- First aid creme or ointment.

- Several gauze pads 3 or 4 inches square for deep wounds with excessive bleeding.

- Acetaminophen for relieving pain and reducing fever.
- A needle for removing splinters.

- A first aid manual which outlines diagnosis and treatment procedures.
- A single-edged razor blade for minor surgery, cutting tape to size, and shaving hairy spots before taping.
- A 2-inch roll of gauze bandage for large cuts.
- A triangular bandage for large wounds.
- A large compress bandage to hold dressings in place.
- A 3-inch wide elastic bandage for sprains and applying pressure to bleeding wounds.
- If a participant is sensitive to bee stings, include their doctor-prescribed antihistamine.

Be sure you have emergency telephone numbers and medical information with you at the field site for everyone participating in field work in case there is an emergency.